

What is claimed is:

1. A substantially formaldehyde-free duct liner comprising:  
a fiber component; and  
a non-liquid substantially formaldehyde-free binder bonding at least a portion of  
said fiber component together, wherein said duct liner has a substantially uniform density  
throughout its volume.
2. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free  
binder is substantially the only binder in said duct liner.
3. The duct liner of claim 1, wherein said fiber component comprises virgin textile  
glass fibers.
4. The duct liner of claim 1, wherein said fiber component comprises virgin textile  
glass fibers, virgin rotary glass fibers, wood fibers, hemp fibers, cellulose fibers or a  
combination thereof.
5. The duct liner of claim 3, wherein said textile glass fibers have an average fiber  
diameter of about 1 to 20 micrometers.
6. The duct liner of claim 3, wherein said textile glass fibers have an average fiber  
diameter of about 5 to 16 micrometers.
7. The duct liner of claim 3, wherein said textile glass fibers have an average fiber  
length of about 1 to 20 cm.
8. The duct liner of claim 1, wherein said textile glass fibers have an average fiber  
length of about 2.5 to 12.5 cm.

9. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free binder is about 10 to 30 wt. % of the duct liner.

10. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free binder is about 12 to 25 wt. % of the duct liner.

11. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free binder is about 15 to 20 wt.% of the duct liner.

12. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free binder comprises plastic-containing bonding fibers, wherein said fiber component and said plastic-containing bonding fibers being uniformly blended and bonded together by a portion of the plastic of said plastic-containing bonding fibers.

13. The duct liner of claim 12, wherein said plastic-containing bonding fibers comprise bi-component polymeric fibers.

14. The duct liner of claim 12, wherein said plastic-containing bonding fibers comprise mono-component polymeric fibers.

15. The duct liner of claim 12, wherein said plastic-containing bonding fibers comprise plastic coated mineral fibers.

16. The duct liner of claim 1, wherein said non-liquid substantially formaldehyde-free binder comprises a thermoplastic or thermosetting powder binder.

17. The duct liner of claim 1, wherein said duct liner has a density of about 16 to 56 kg/m<sup>3</sup>.

18. The duct liner of claim 1, wherein said duct liner has a density of about 24 to 48 kg/m<sup>3</sup>.

19. The duct liner of claim 1, wherein said duct liner has a gram weight of about 50 to 350 gm/m<sup>2</sup>.
20. The duct liner of claim 1, wherein said duct liner has a gram weight of about 65 to 310 gm/m<sup>2</sup>.
21. The duct liner of claim 1, wherein said duct liner has a first side and a second side and further comprises a facing layer bonded to at least one of the two sides.
22. The duct liner of claim 21, wherein said facing layer is a non-woven scrim sheet of randomly oriented natural or synthetic fibers.
23. The duct liner of claim 22, wherein said non-woven scrim is made from fibers of glass, polyolefin, polyamide, polyester or rayon.
24. The duct liner of claim 21, wherein at least one of said duct liner and said facing layer is treated with a water resistant additive made of epoxy foam, acrylic or asphalt.
25. The duct liner of claim 21, wherein at least one of said duct liner and said facing layer is treated with an anti-microbial agent.
26. The duct liner of claim 13, wherein said bi-component polymeric fibers comprise:
  - a core material; and
  - a sheath material,wherein said sheath material has a melting point temperature that is lower than the melting point temperature of said core material.
27. The duct liner of claim 26, wherein said bi-component polymer fibers are made from a thermoplastic or thermosetting polymer.

28. The duct liner of claim 27, wherein said sheath and said core materials are made of a thermoplastic or thermosetting polymer formulated to have different melting points for the sheath and the core.
29. The duct liner of claim 26, wherein said core material is mineral and said sheath material is a thermoplastic or thermosetting polymer.
30. The duct liner of claim 1, wherein said at least one non-liquid substantially formaldehyde-free binder is a mixture of plastic-containing bonding fibers and at least one substantially formaldehyde-free powder binder.
31. The duct liner of claim 30, wherein said plastic-containing bonding fiber comprises about 20 to 100 wt. % of said non-liquid substantially formaldehyde-free binder.
32. A substantially formaldehyde-free duct liner comprising:
  - a final mat having a first side and a second side, the mat comprising:
    - a fiber component;
    - a non-liquid substantially formaldehyde-free binder bonding at least a portion of said fiber component together, wherein said duct liner has a substantially uniform density throughout its volume; and
    - a facing layer bonded to at least one of the two sides.
33. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder is substantially the only binder in the duct liner.
34. The duct liner of claim 32, wherein said fiber component comprises virgin textile glass fibers.

35. The duct liner of claim 32, wherein said fiber component comprises virgin textile glass fibers, virgin rotary glass fibers, wood fibers, hemp fibers, cellulose fibers or a combination thereof.
36. The duct liner of claim 32, wherein said textile glass fibers have an average fiber diameter between about 1 and 20 micrometers.
37. The duct liner of claim 32, wherein said textile glass fibers have an average fiber diameter between about 5 and 16 micrometers.
38. The duct liner of claim 32, wherein said textile glass fibers have an average fiber length of about 1 to 20 cm.
39. The duct liner of claim 32, wherein said textile glass fibers have an average fiber length of about 2.5 to 12.5 cm.
40. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder is about 10 – 30 wt. % of the duct liner.
41. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder is about 12 – 25 wt. % of the duct liner.
42. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder is about 15 to 20 wt. % of the duct liner.
43. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder comprises plastic-containing bonding fibers, wherein said fiber component and said plastic-containing bonding fibers being uniformly blended and bonded together by a portion of the plastic of said plastic-containing bonding fibers.

44. The duct liner of claim 43, wherein said plastic-containing bonding fibers are bi-component polymeric fibers.
45. The duct liner of claim 43, wherein said plastic-containing bonding fibers are mono-component polymeric fibers.
46. The duct liner of claim 43, wherein said plastic-containing bonding fibers comprise thermoplastic-coated mineral fibers.
47. The duct liner of claim 32, wherein said non-liquid substantially formaldehyde-free binder comprises a thermoplastic or thermosetting powder binder.
48. The duct liner of claim 32, wherein said duct liner has a density of about 16 to 56 52.5 kg/m<sup>3</sup>.
49. The duct liner of claim 32, wherein said duct liner has a density of about 24 to 48 kg/m<sup>3</sup>.
50. The duct liner of claim 32, wherein said duct liner has a gram weight of about 50 to 350 gm/m<sup>2</sup>.
51. The duct liner of claim 32, wherein said duct liner has a gram weight of about 65 to 310 gm/m<sup>2</sup>.
52. The duct liner of claim 32, wherein said facing layer is a non-woven scrim sheet of randomly oriented natural or synthetic fibers.
53. The duct liner of claim 52, wherein said non-woven scrim is made from fibers of glass, polyolefin, polyamide, polyester or rayon.

54. The duct liner of claim 32, wherein at least one of said duct liner and said facing layer is treated with a water resistant additive made of epoxy foam, acrylic or asphalt.

55. The duct liner of claim 32, wherein at least one of said duct liner and said facing layer is treated with an anti-microbial agent.

56. The duct liner of claim 44, wherein said bi-component polymeric fibers comprise:  
a core material; and  
a sheath material, wherein said sheath material has a melting point temperature that is lower than the melting point temperature of said core material.

57. The duct liner of claim 56, wherein said bi-component polymer fibers are made from a thermoplastic or thermosetting polymer.

58. The duct liner of claim 57, wherein said sheath and the core materials are made of a thermoplastic or thermosetting polymer formulated to have different melting points for said sheath and said core.

59. The duct liner of claim 56, wherein said core material is mineral and said sheath material is a thermoplastic or thermosetting polymer.

60. The duct liner of claim 56, wherein said at least one non-liquid substantially formaldehyde-free binder is a mixture of plastic-containing bonding fibers and at least one substantially formaldehyde-free powder binder.

61. The duct liner of claim 60, wherein said plastic-containing bonding fiber comprises about 20 to 100 wt. % of said non-liquid substantially formaldehyde-free binder.

62. A method of making substantially formaldehyde-free duct liner, comprising the steps of:

opening bulk fiber component;  
blending the opened fiber component of said duct liner and a non-liquid substantially formaldehyde-free binder into a fiber blend;  
forming said fiber blend into a mat having a first side and a second side;  
applying a facing layer to at least one of said first and the second sides; and  
heating said mat and said facing layer to form a substantially formaldehyde-free duct liner.

63. The method of claim 62, wherein said step of opening said fiber component further comprising the step of weighing said opened fibers to monitor said opened fibers' feed rate.

64. The method of claim 63, wherein the step of forming said fiber blend into said mat further comprising:

continuously weighing said mat to ensure that said blended fibers' flow rate is at a desired rate.

65. The method of claim 64, further comprising the step of comparing said feed rate of the opened fibers and said flow rate of the blended fibers in a feed back loop to control the speed of said opening step.

66. The method of claim 62, wherein said heating step comprises heating said mat at a temperature less than about 200°C.

67. The method of claim 62, further comprising the step of:

applying a formaldehyde-free powder binder on to said mat before applying said facing layer to at least one of said first and the second sides of said mat.

68. The method of claim 62, wherein said fiber component comprises textile glass fibers.

69. The method of claim 68, wherein said textile glass fibers have an average fiber diameter between about 1 and 20 micrometers.

70. The method of claim 68, wherein said textile glass fibers have an average fiber diameter between about 5 and 16 micrometers.

71. The method of claim 68, wherein said textile glass fibers have an average fiber length of about 1 to 20 cm.

72. The method of claim 68, wherein said textile glass fibers have an average fiber length of about 2.5 to 12.5 cm.

73. The method of claim 62, wherein said fiber component comprises virgin textile glass fibers, virgin rotary glass fibers, wood fibers, hemp fibers, cellulose fibers or a combination thereof.

74. The method of claim 62, wherein said non-liquid substantially formaldehyde-free binder is about 10 to 30 wt. % of the duct liner.

75. The method of claim 62, wherein said non-liquid substantially formaldehyde-free binder is about 12 to 25 wt. % of the duct liner.

76. The method of claim 62, wherein said non-liquid substantially formaldehyde-free binder is about 15 to 20 wt. % of the duct liner.

77. The method of claim 62, wherein said non-liquid substantially formaldehyde-free binder comprises plastic-containing bonding fibers.

78. The method of claim 77, wherein said plastic-containing bonding fibers comprise bi-component polymeric fibers.

79. The method of claim 77, wherein said plastic-containing bonding fibers comprise mono-component polymeric fibers.

80. The method of claim 62, wherein said non-liquid substantially formaldehyde-free binder comprises a thermoplastic or thermosetting powder binder.

81. The method of claim 62, wherein said duct liner has a density of about 16 to 56 kg/m<sup>3</sup>.

82. The method of claim 62, wherein said duct liner has a density of about 24 to 48 kg/m<sup>3</sup>.

83. The method of claim 62, wherein said duct liner has a gram weight of about 50 to 350 gm/m<sup>2</sup>.

84. The method of claim 62, wherein said duct liner has a gram weight of about 65 to 310 gm/m<sup>2</sup>.

85. The method of claim 78, wherein said bi-component polymeric fibers comprise:  
a core material; and  
a sheath material,

wherein said sheath material has a melting point temperature that is lower than the melting point temperature of said core material.

86. The method of claim 85, wherein said bi-component polymer fibers are made of thermoplastic or thermosetting polymer.

87. The method of claim 85, wherein said at least one non-liquid substantially formaldehyde-free binder is a mixture of plastic-containing bonding fibers and at least one powder binder.

88. The method of claim 87, wherein said plastic-containing bonding fiber comprises about 20 to 100 wt. % of said non-liquid substantially formaldehyde-free binder.

89. The method of claim 87, wherein said plastic-containing bonding fiber comprises thermoplastic resin, thermosetting resin, or both.